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Subject: Bark Beetle Activity in Recreation Sites and Dogtown Fuel Reduction and Forest Health Project on the Williams RD (williamsrd)

To: District Ranger, Williams RD, Kaibab NF

On September 28, 2004, I visited four campgrounds on the Williams RD, Kaibab NF, at the request of Robin Rose to evaluate the areas for bark beetle activity. My evaluation consisted of ground surveys to identify currently infested trees within and adjacent to the recreation areas. In addition, on September 28th, I conducted a brief survey of bark beetle activity within the Dogtown Fuels and Forest Health Project at the request of Chris Worthington. I describe in this report what bark beetle activity was observed in these areas, summarize silvicultural treatments to reduce bark beetle stand susceptibility, and make recommendations to minimize bark beetle impacts. Additional discussion of prevention and suppression activities aimed at reducing bark beetle caused impacts in recreation sites was provided in a site visit report sent to the District in October 2003.

Bark beetle activity on the Kaibab National Forest

Both aerial detection surveys and ground surveys conducted by FHP have found high levels of bark beetle-killed ponderosa pine on the Kaibab NF over the last three years. Inspection of fading trees and collected specimens determined that several species of pine engraver beetles (*Ips pini*, *I. lecontei*, *I. calligraphus*) and western pine beetle (*Dendroctonus brevicomis*) are the primary cause of pine mortality. These bark beetles are widespread throughout the West and can occasionally reach outbreak proportions (Kegley, et al., 1997; DeMars and Roettgering, 1982). In 2002, most of the trees were initially attacked by *Ips* species and then subsequently infested by western pine beetle. This allowed western pine beetle populations to increase. Starting in the summer of 2003 and continuing in 2004, we have seen attacks on many large diameter pines and pockets of second growth pine initiated by western pine beetle.

A detailed summary of the aerial detection survey results will be provided to the Forest at a later date; however, our analysis showed that ponderosa pine mortality occurred on more than 50,000 acres in late 2002 through mid-summer 2003. For the period of late 2003 through mid-summer 2004, an additional 20,000+ acres were being impacted by bark beetles (*Ips* and western pine beetle) on the Forest minus the Tusayan RD. This trend of decreased activity is similar to what has been observed in the majority of Arizona during 2004. There are still areas that are experiencing considerable pine mortality and the population of bark beetles is still relatively high.

Bark Beetle Activity in Developed Recreation Sites on the Williams RD

Trees growing in developed recreation sites are often stressed due to repeated damage caused by campers and soil compaction caused by roads and large vehicles parked off-road. During periods of drought or below-average precipitation such as has been occurring over the last few years, these trees can become particularly stressed. This is further exacerbated by the relatively high density of ponderosa pine growing in some areas of the campgrounds. When trees are growing at high densities, there is more inter-tree competition for resources such as light, water, and nutrients (Kolb, et al., 1998). The combined effect of these factors is to lower the trees' production of defensive compounds and, consequently, increase susceptibility to bark beetle attack. Bark beetles may also prefer these dense stands, compared with more open stands, due to microclimate differences (Amman and Logan, 1998). This combination of factors increasing tree susceptibility seemed to be what occurred within the recreation sites on the Williams RD over the last 3 years.

To reduce the local population of bark beetles within the vicinity of the recreation sites, removal of infested trees at all four of the recreation sites occurred in the spring of 2004. In addition, thinning of ponderosa pine stands to reduce the long-term susceptibility of the recreation sites are scheduled for the fall of 2004 (will start on October 12, 2004). A total of 400 acres across the four sites will have noncommercial thinning of trees up to 9 to 11 inches diameter to an average spacing of 30 feet. Slash will be cut and piled and then piles burned at a later date.

My surveys of the four recreation sites consisted of walkthroughs looking for fading trees, pitch tubes, and boring dust. It is important to note that additional trees may have become infested after my survey was completed. Therefore, the numbers of infested trees reported here should not be considered absolute.

Cataract Lake Campground

Only two small ponderosa pine (< 6 inches dbh) were currently infested throughout the campground. Relatively few infested trees were observed across Cataract Lake and elsewhere in the vicinity.

Kaibab Lake Campground

Fourteen current infested ponderosa pines were identified within the immediate campground area (***Figures 1***). An additional 22 trees had been attacked earlier in 2004, but beetles had already emerged. *Ips* beetles and western pine beetle attacked all age classes of ponderosa pine. The stand structure throughout the campground is patchy and uneven-aged, with some areas having clumps of dense pine and other areas with well-spaced diameter trees.

Figure 1. *Bark beetle-infested ponderosa pine at Kaibab Lake Campground.*

Dogtown Lake Campground

Only one current infested ponderosa pine trees was identified within the immediate campground area. Additional three trees had been attacked earlier in 2004, but beetles had already emerged from the trees. A limited amount of current infested trees were observed across the lake and elsewhere in the vicinity.

Whitehorse Lake Campground

No new bark beetle activity was observed within the immediate campground area. A limited amount of bark beetle activity was observed across the lake and elsewhere in the vicinity.

Dogtown Fuels Reduction and Forest Health Project

The primary goal for this analysis area is to effectively reduce hazardous fuels and tree stocking levels so the forest can support future low-intensity fires, a reduced fire risk, and a reduction in density-dependent insect and disease mortality agents, such as bark beetles. A variety of vegetation treatment activities are proposed including group selection tree removal, grassland maintenance, and irregular thinning (both commercial and pre-commercial). The irregular thinning prescription will include non-commercial thinning of trees up to 9 to 11 inches diameter to an average spacing of 25 to 30 feet on 778 acres. Ponderosa pine up to 12 inches in diameter will be cleared for 20 to 30 feet around large oak and yellow pine. Thinning slash will be lopped and scattered to a height of 2 feet or less on 528 acres. Thinning slash will be machine piled on 250 acres in the wildland urban interface and in areas where it is excessive.

Figure 2. *Pocket of bark beetle-caused ponderosa pine mortality within the Dogtown Fuels Reduction and Forest Health Project.*

I examined areas proposed for non-commercial irregular thinning for bark beetle activity and general stand conditions. Areas inspected included along Forest Service roads 140, 141, 720 and 48. Most of these areas had stand basal areas greater than 120 $ft.^2$/ac and were experiencing low to moderate bark beetle activity (***Figure 2***).

Silvicultural treatments for reducing bark beetle susceptibility

Management of bark beetle populations falls under two categories: direct action against the beetles themselves (suppression) or indirect action that addresses the general stand conditions (prevention). Direct action deals with the symptoms, too many beetles in one place at one time, and is aimed at directly reducing the number of beetles present. Indirect action focuses on the cause of the problem, which relates to optimal stand conditions for beetle buildup and outbreak. The only effective long-range strategy to minimize beetle-caused mortality is controlling stand conditions through silvicultural means over large areas and constant monitoring for areas of beetle buildup.

Silvicultural treatments are designed to increase tree vigor and reduce stand susceptibility to beetle attack through reducing basal area or controlling other stand conditions. They are preventive treatments that should be completed prior to stands experiencing beetle outbreaks. Stand hazard rating for *Dendroctonus* bark beetles of ponderosa pine involves measures of tree size, stand or group density (basal area), and the percent of host trees within the stand. No stand hazard rating models have been validated for pine engraver beetles species attacking ponderosa pine in Arizona, primarily because beetle populations are often driven by drought and factors leading to large amounts of slash. Stand hazard rating for *Dendroctonus* bark beetles attacking ponderosa pine typically involves measures of tree size, density (basal area or stand density index), and the percent of host trees within the stand. In general, ponderosa pine stands that have an average DBH greater than 12 inches and a basal greater than 120 ft^2/acre are considered at high risk to bark beetle attack, stand basal area of 80 – 120 ft^2/acre are moderate risk, and stand basal area less than 80 ft^2/acre are considered low risk (Schmid and Mata, 1992; Chojnacky et al., 2000; Negrón et al., 2000).

Although no stand hazard rating system has been developed for bark beetles attacking ponderosa pine on the Williams RD specifically, Munson and Anhold (1995) developed the following stand hazard rating system for mountain pine beetle in ponderosa pine (table below modified from Chojnacky et al., 2000). This hazard rating system was validated across several sites including the North Kaibab in Arizona.

% PP		Ave. PP DBH		Basal Area (ft^2/ac)		Composite Stand Hazard Values	Hazard Rating
>85	(3)	>12	(3)	>120	(3)	8 – 9	High
50-85	(2)	8-12	(2)	80-120	(2)	5 – 7	Moderate
<50	(1)	<8	(1)	<80	(1)	3 – 4	Low

For prevention of western pine beetle attacks in California, thinning of dense, 70- to 80-year-old sawtimber stands is an effective silvicultural method for managers of both small and large holdings (DeMars and Roettgering, 1982). Demars and Roettgering (1982) state that by reducing stand stocking to 55 to 70 percent of the basal area needed for full site utilization will relieve the competitive stress among the residual trees, improve their vigor, and make them less prone to successful bark beetle attack.

Because of the more xeric conditions in the Arizona compared to other western states that have ponderosa pine, the low risk category may be even less than 80 ft^2/acre. Also, because of the large complex of pine engraver beetles that typically cause the majority of ponderosa pine in the Arizona, average stand diameter may not be as important as other areas in the West where *Dendroctonus* beetles cause most of the tree mortality.

If thinning projects are undertaken, careful management of the slash is required while populations are high. Thinning will usually be most effective in areas that are not currently experiencing high levels of beetle activity. In general, population increases of pine engraver beetle can be minimized by implementing thinning projects after the onset of the monsoon season through December. Cutting trees during this season will allow the material to partially

dry out before beetles fly in the spring. Also standing residual trees may be less susceptible during this time due to increased soil moisture caused by the monsoon rains. Slash generated from January through May typically remains moist and enhances beetle population increases. While this is a good general recommendation when beetle populations are relatively low, we have observed pine engraver beetles to complete at least one generation in slash generated during the fall of 2002 and 2003 on most Forests in Arizona. If this timing approach is being used, and trees are only lopped and left on untreated on the site, there are a couple points to consider. First, slash generated on more exposed areas that have relatively low residual basal area will likely dry out more by the time beetles fly in the spring. Second, on steeper slopes or where the residual basal area is still relatively high, slash may not adequately dry out by the time beetles fly in the spring.

Another general "rule of thumb" approach to preventing pine engraver beetles from impacting areas where thinning projects are being implemented is to separate project areas either in time and/or in space. Beetle populations probably will remain relatively low if thinning projects are conducted every other year. Similarly, a buffer of over two miles between management sites is also thought to prevent mass movement of beetles from one area to another. If thinning treatments are implemented in consecutive years, there likely will be a build up of pine engraver beetles that can move from one thinning project to the next.

The best preventive strategy to minimize pine engraver beetle activity related with thinning projects and associated slash is to utilize the larger diameter slash. Harvesting most ponderosa pine slash larger than 4 inches in diameter will help to prevent beetle populations increases because few beetles are produced in slash less than 4 inches because this material dries out quicker and there can be more competition for less food. The larger diameter slash should be removed from the site or treated within 28 days of being generated if thinning occurs during active beetle flight periods (April through early October). If thinning occurs during November through March, the larger diameter material should be removed or treated before the time beetles complete their first generation in the spring (i.e., by early May). If slash does become infested in April, removing or treating the newly infested material may aid in reducing the local population of pine engraver beetles.

Recommendations

Recreation Sites

Because of the relatively low bark beetle activity within the recreation sites surveyed, I do not recommend using preventative sprays for protecting high value trees at this time. In the short-term, prompt removal of currently infested trees will help to reduce the immediate local population of beetles. However, because these insects are very common, removal of infested trees is not a guarantee of protection. Therefore, this approach is generally recommended in combination with the long-term preventive approach of maintaining stand conditions that are low in susceptibility. The removal of infested trees this fall at the same time thinning treatments are taking place should reduce the short-term susceptibility of these areas to bark beetle attack. The thinning treatments should decrease the long-term susceptibility of these areas to bark beetle attack. Felling of infested trees will not kill developing brood; infested trees must either be removed from the site or treated on site. Bark beetles should not be flying in large numbers during the time of thinning in October and November and therefore the slash should not pose a

risk. However, because the thinning slash generated this fall will remain on the ground when beetles begin flying next spring, there is a certain amount of risk that this material will still be suitable for brood production. In particular, the larger diameter slash may be suitable for colonization and brood production in the spring. Careful monitoring of the slash and surrounding trees in the spring should be conducted to determine the amount of risks to the residual trees and surrounding areas.

Dogtown Fuels Reduction and Forest Health Project

Although the irregular thinning treatments do not include a target basal area, most of the areas treated should have a resulting basal area below 80 $ft.^2$ per acre; this will help to reduce the overall susceptibility of stands within the Dogtown Fuels Reduction and Forest Health Project in the long term. Thinning from below has been experimentally demonstrated to increase the resistance level of the residual mature pine overstory (Feeney, et al., 1998). As mentioned above, thinning slash may pose a short-term risk to residual trees in the thinning units or surrounding areas depending on the timing of thinning, local population of *Ips*, and site and environmental factors such as site quality and precipitation.

Prevention and Suppression funds may be available for FY2005 from Forest Health Protection to implement projects related to bark beetle activity in these recreation sites. Requests for these funds should be submitted no later than October 15, 2004.

If you have any questions regarding my assessment of current bark beetle activities within the area, its potential effect on residual standing trees, or my recommendations, please let me know.

/s/ Joel D. Mcmillin
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cc: Mailroom R3 Kaibab, Robin G Rose, Christopher M Worthington, Deirdre A McLaughlin, Mark W Herron, James A Hall, Leonard Lucero, John Anhold, Debra Allen-Reid

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